



Explore The Possibilities

Bob Gemin WPAFB Educational
Outreach

A Puzzle and an
Adventure



Have you ever
asked yourself,

***“Why would
I want to
learn
science over
any other
subject?”***



Science is unique in that science facts are not determined by man, it is not a language or history of man, it is not governed by the rules of man.

Science is not subjective since the facts of science would be true without their discovery.

Periodic Table of Elements

1	2																	3	4
1	H																	2	He
2	3	4																	10
	Li	Be																	Ne
3	11	12																	18
	Na	Mg																	Ar
4	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
5	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	
	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
6	55	56	57	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	
	Cs	Ba	*La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
7	87	88	89	104	105	106	107	108	109	110									
	Fr	Ra	+Ac	Rf	Ha	106	107	108	109	110									

* Lanthanide Series

+ Actinide Series

58	59	60	61	62	63	64	65	66	67	68	69	70	71
Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
90	91	92	93	94	95	96	97	98	99	100	101	102	103
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

Legend - click to find out more...

H - gas

Li - solid

Br - liquid

Tc - synthetic

Non-Metals

Transition Metals

Rare Earth Metals

Halogens

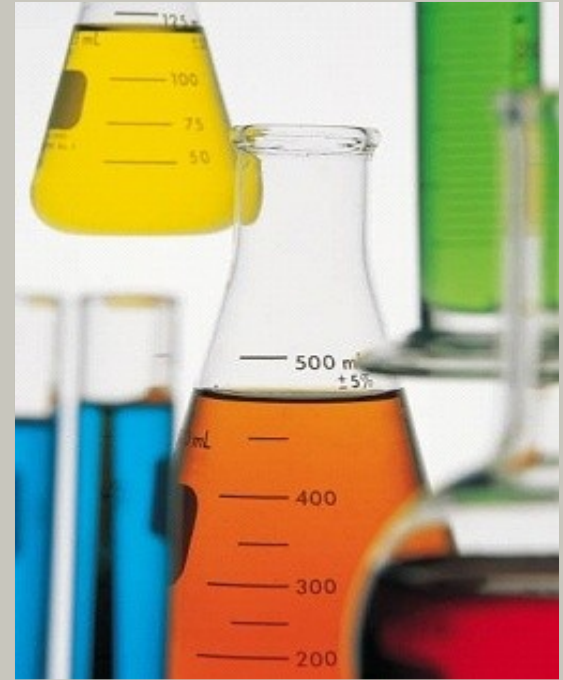
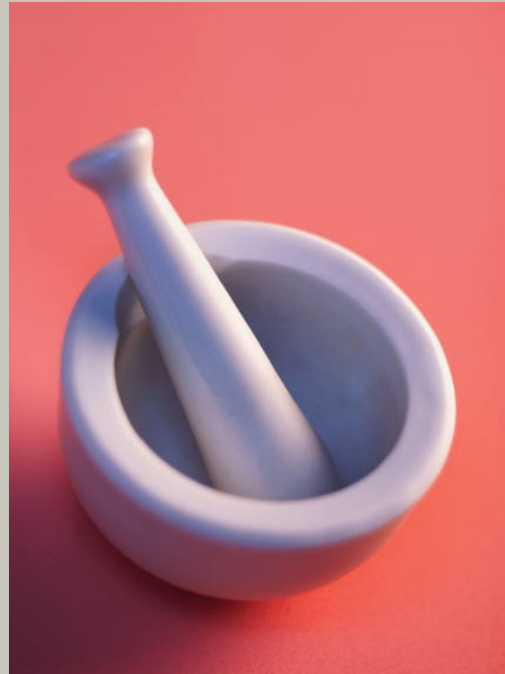
Alkali Metals

Alkali Earth Metals

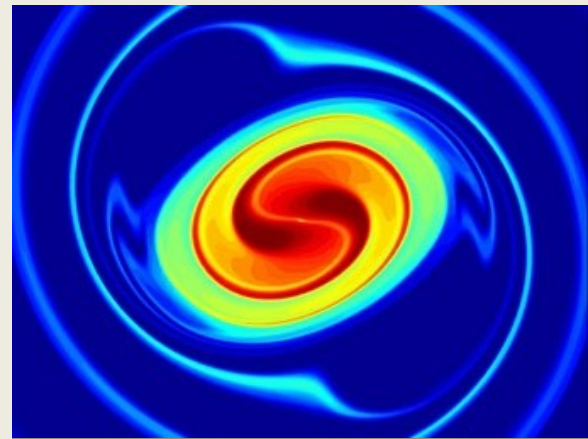
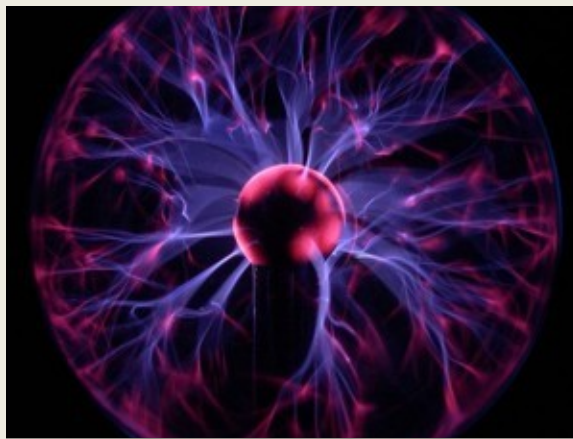
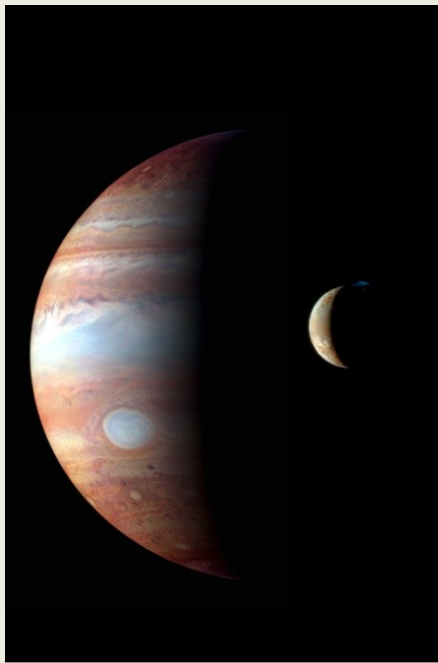
Other Metals

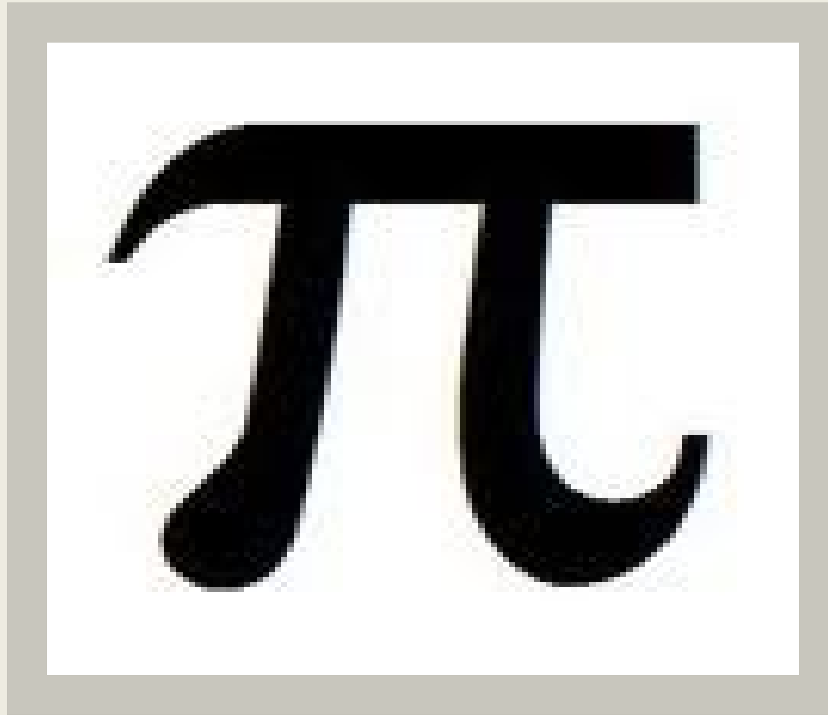
Inert Elements

Yet learning science is not the memorization of facts.



Allow me to
explain why I
believe science
is both an
adventure and
a **puzzle**.





Could someone tell me what is
Pi?

π

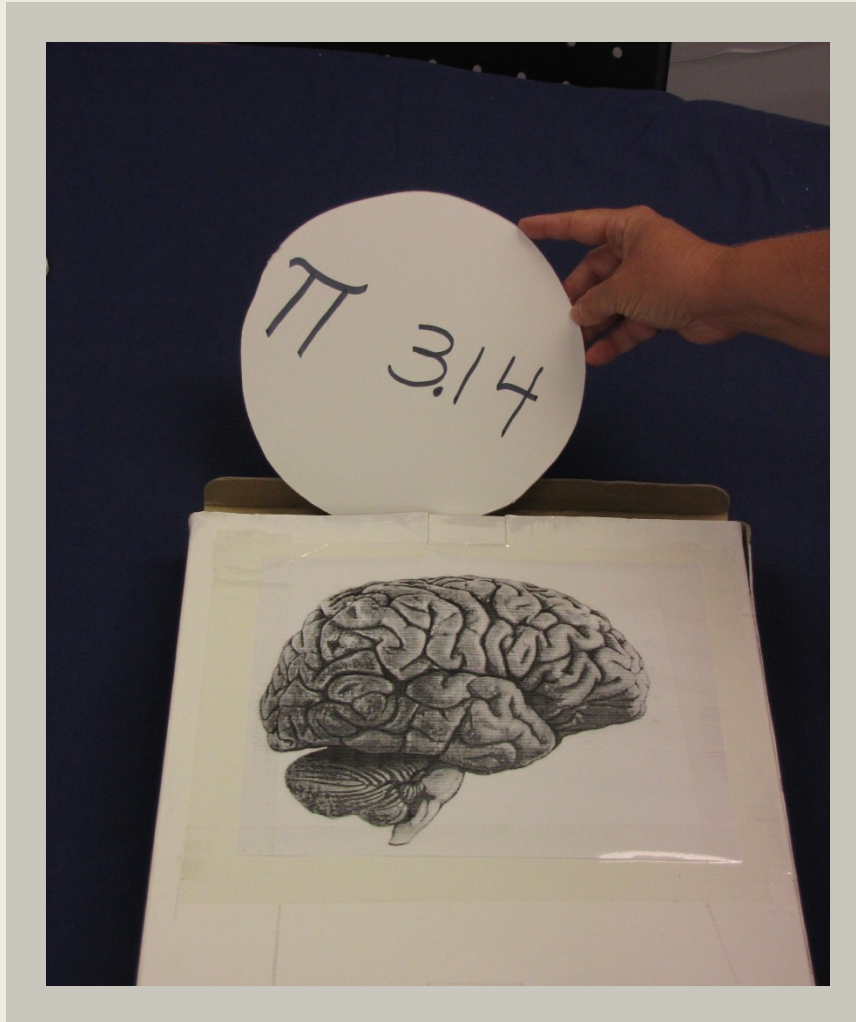
3.141

5926535

8979323846

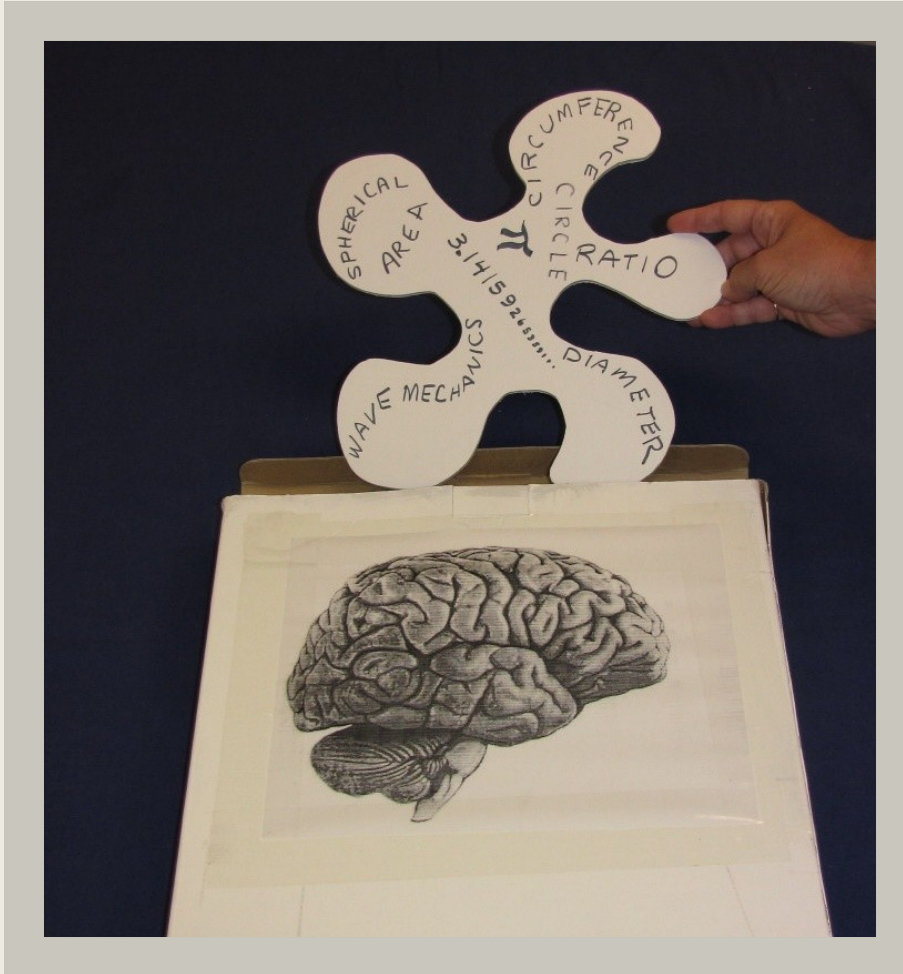
2643383279502

8841971693993751



Think of your brain as a Puzzle. The simple memorization of this fact (Pi) doesn't result in a puzzle piece that fits and connects well to other pieces.

It's just a "fact".



To connect Pi in our memory we need better understanding.

It is the ratio of a circle's circumference to diameter and allows spherical area and wave mechanics calculations.



It is the text or teacher's job to provide good puzzle pieces that can link to other pieces.



It is the student's responsibility to fit the puzzle together by thinking of relationships and solving problems.



If the student is handed too many pieces at one time, some are dropped. The student must start fitting the pieces together or they will just end up with a larger and larger stack of pieces.



If the student only memorizes, like remembering your phone number, the student only has a stack of facts- just a collection of puzzle pieces. **This is not solving the puzzle, it is not learning.**



It is only when you connect the puzzle piece within your present knowledge puzzle picture are you capable of critical thinking.



A teacher
cannot place
a piece
within the
puzzle
picture for
the student.



The teacher only helps the student develop that piece – viewing it from different perspectives.



Only the student can place the fact within their knowledge base.

EUREKA!

Learning this way is
fun!

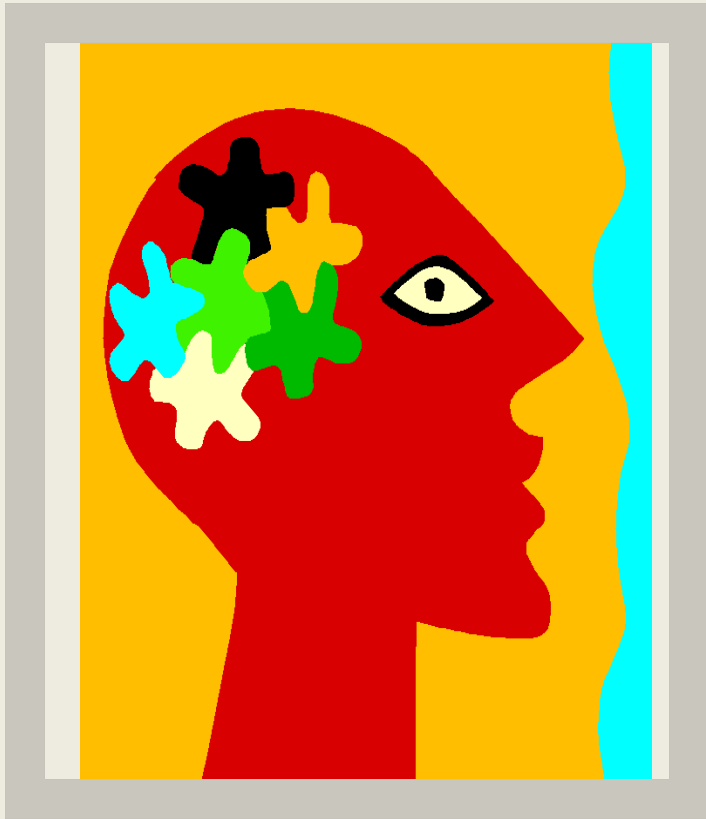


Again, learning science is not memorization and acceptance of faith, it is acceptance by recognizing the connection with what you already know.



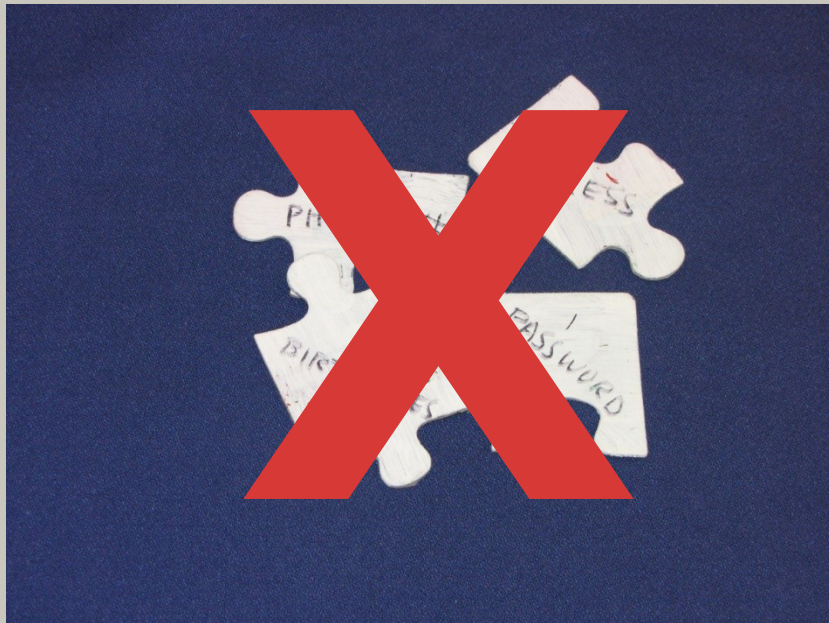
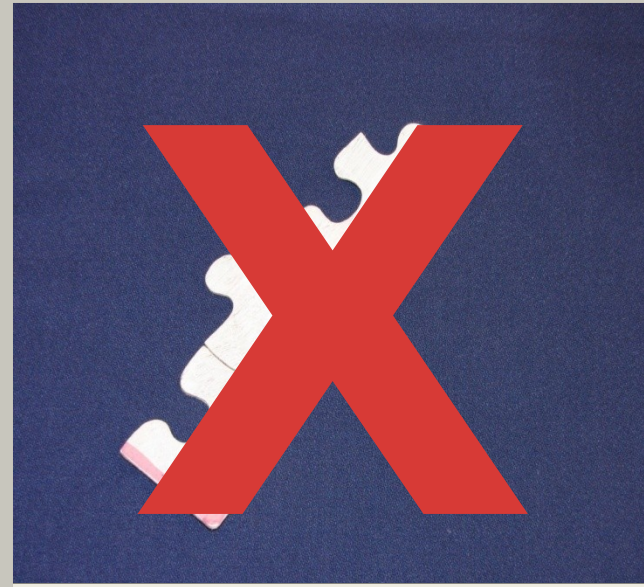
...like fitting in a new puzzle piece into each of our personal picture of rules of nature





Let us take a look at a symbolic two-dimensional version of a three-dimensional puzzle picture in our brain.

Each of our puzzle pictures look different, but there are features in common. There can be no straight borders or corners of our puzzle...



...if there are edges and borders,
additional knowledge could not be
connected to pieces of pre-existing
knowledge.

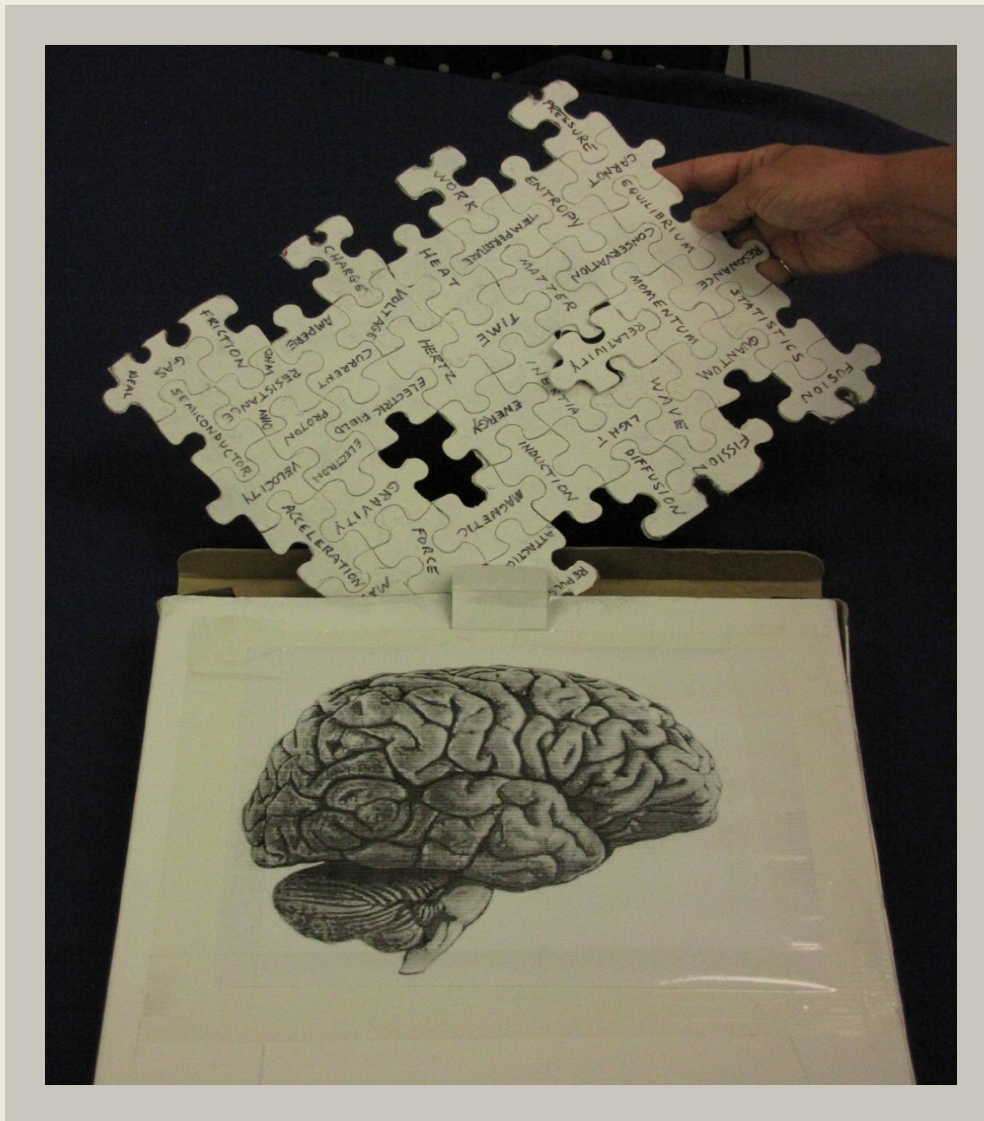




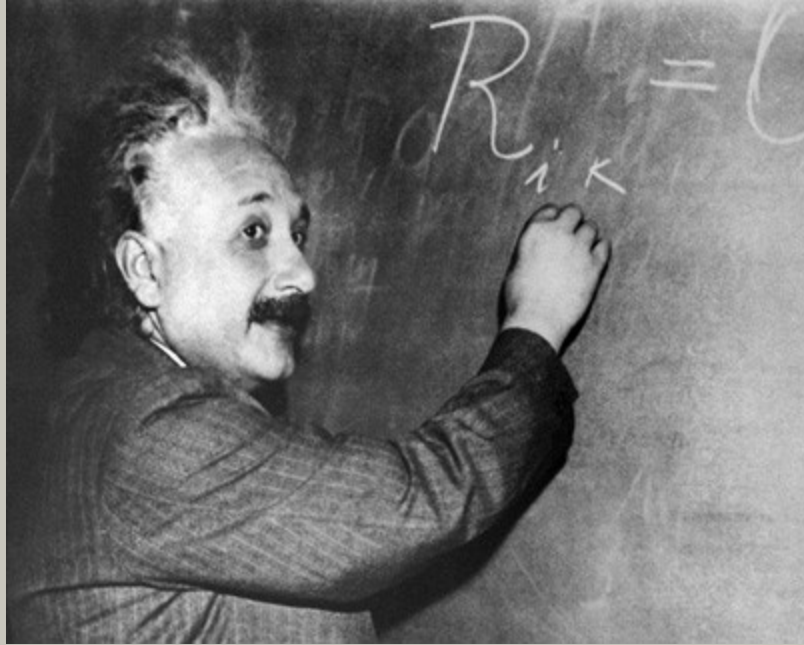
We can never have the complete picture.
There will always be more pieces to add and
holes in our understanding that challenges
us.



The most difficult part of the science puzzle is the pieces that are misplaced or forced into our picture because of faulty understanding or due to theories subject to later clarification.

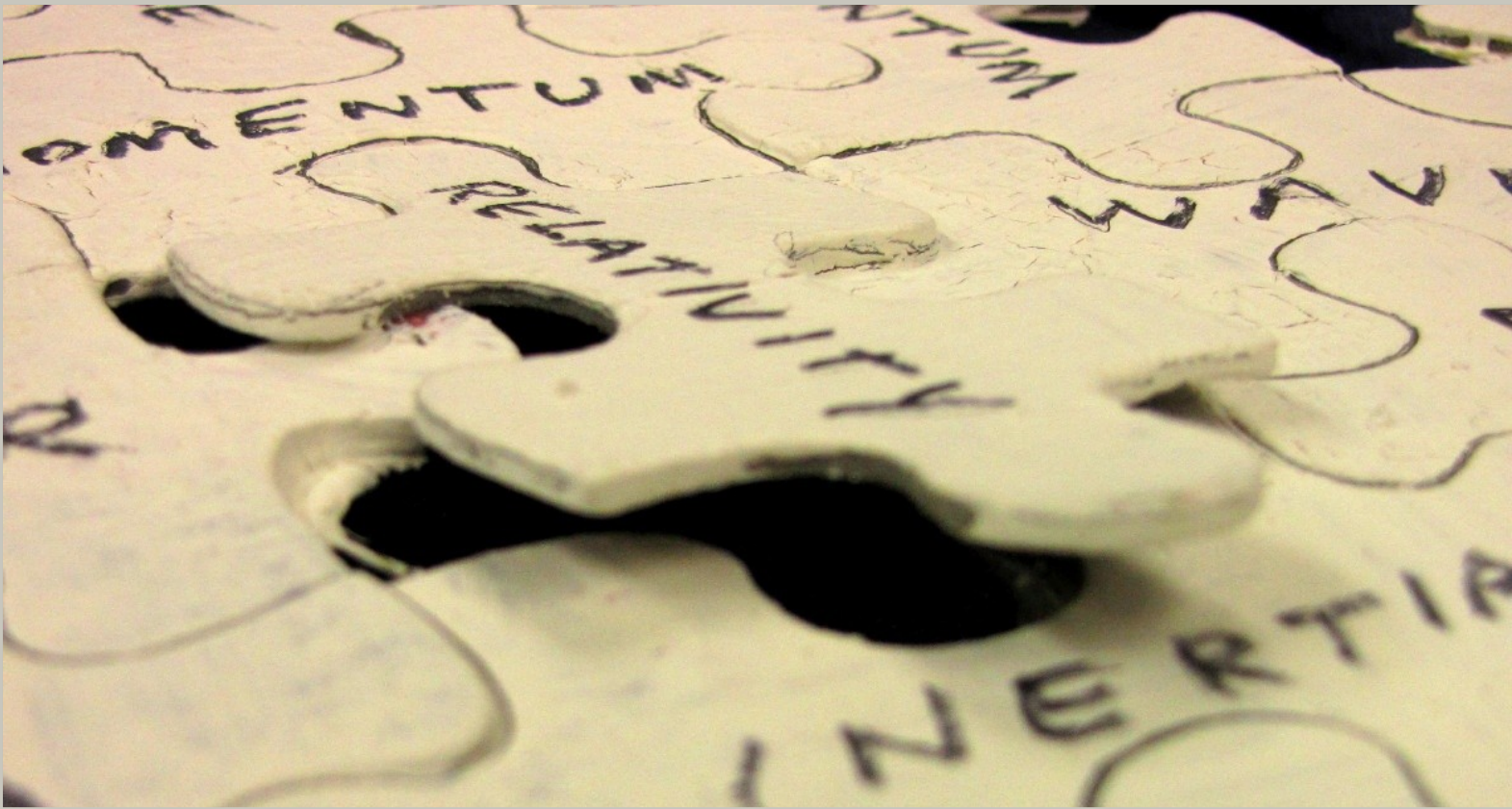


As our knowledge increases and our puzzle is more complete, what were imperfections give insight.

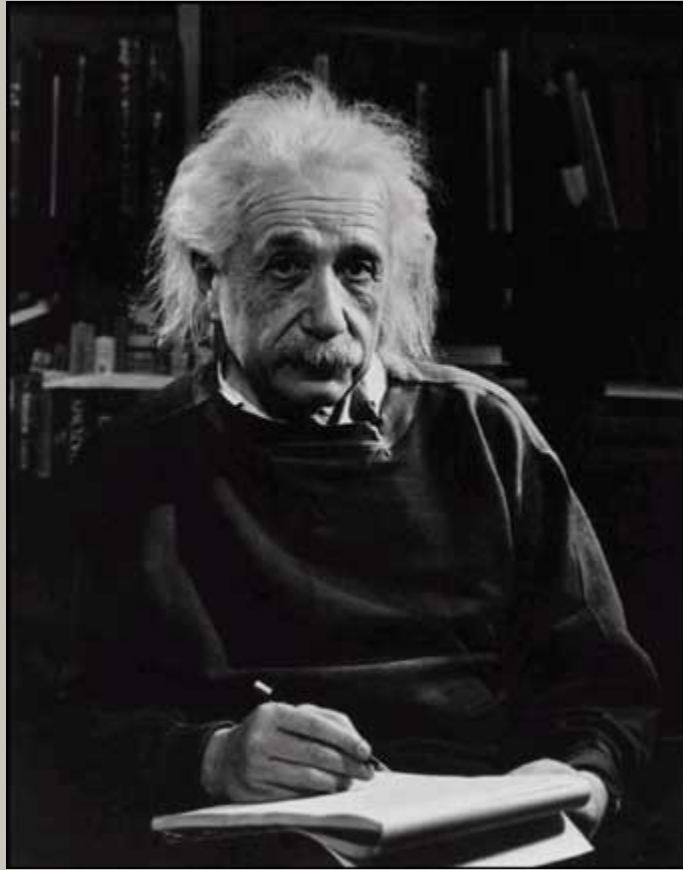


I expect
Einstein sensed
the error in his
puzzle picture
between
Maxwell's
constant light
velocity and
Newtonian
laws.

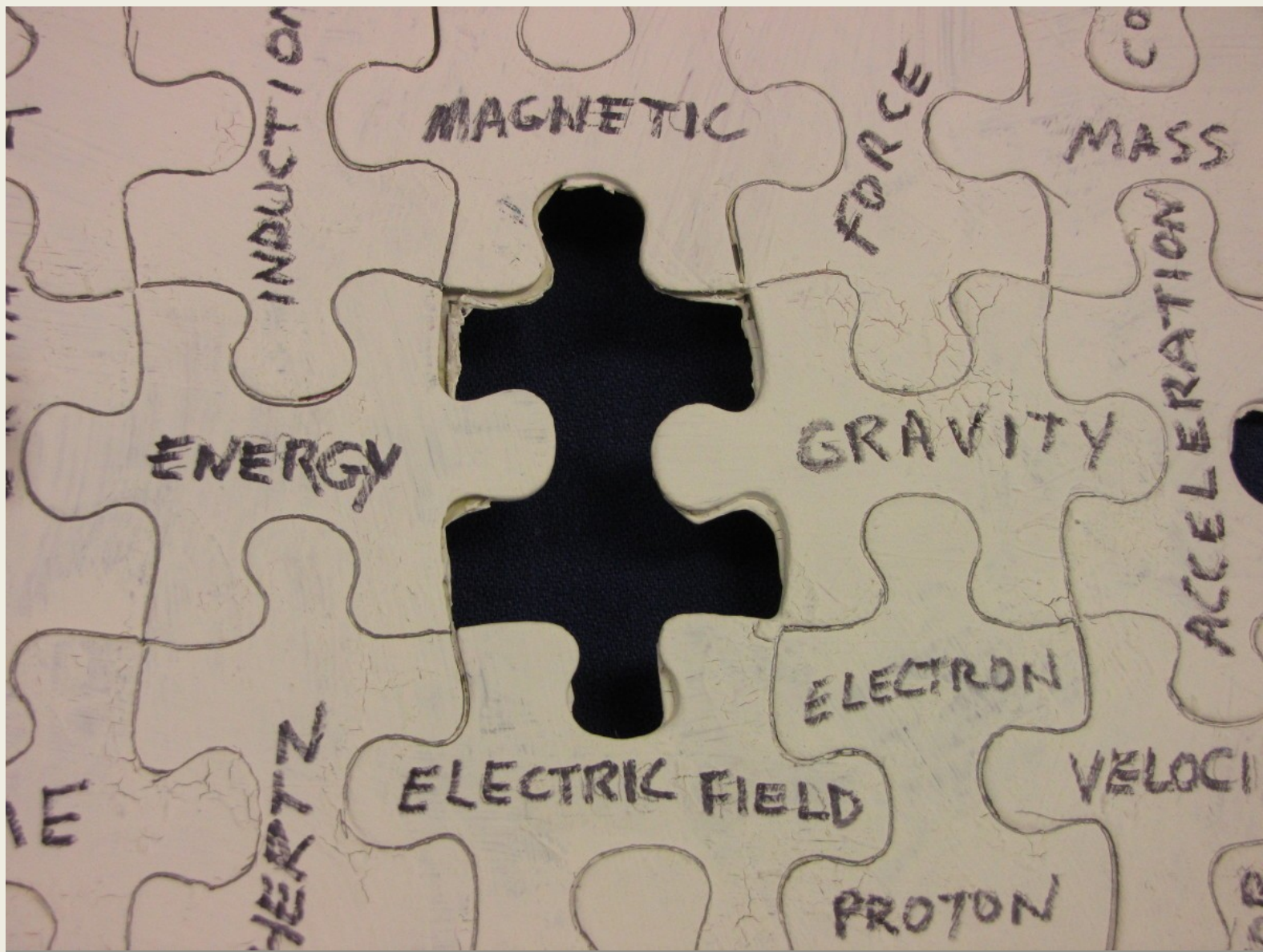




These miss-fitting pieces resulted
in his relatively theories.



Einstein
also saw a
missing
piece that
caused him
to search
for a
unified field
theory.





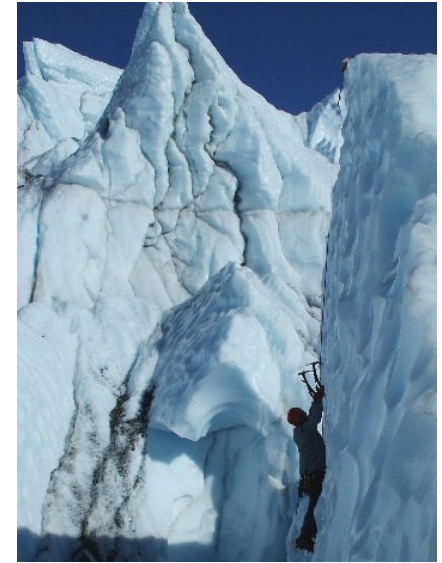
As learners, we must stay open to questioning our understanding and maintain a willingness to rethink our understanding ...like refitting puzzle pieces.

Learning science has a similarity with putting a puzzle together, a game, but more than a game, since the results of science affect our lives dramatically.

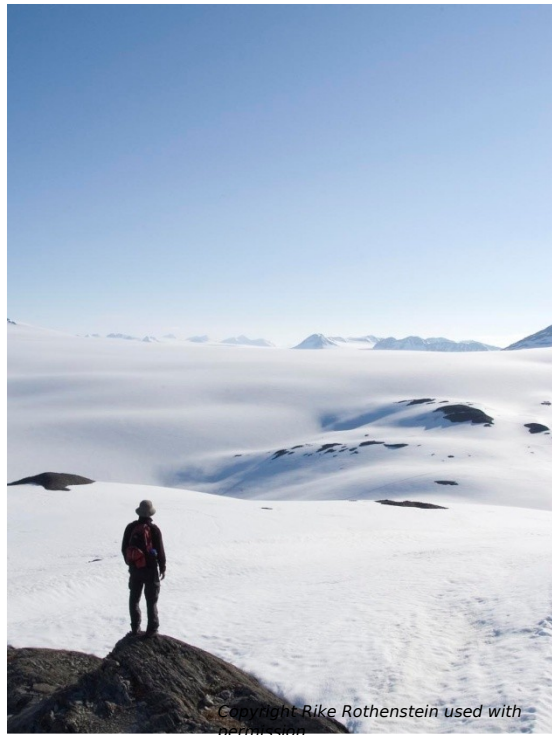




Therefore, learning science is an adventure!



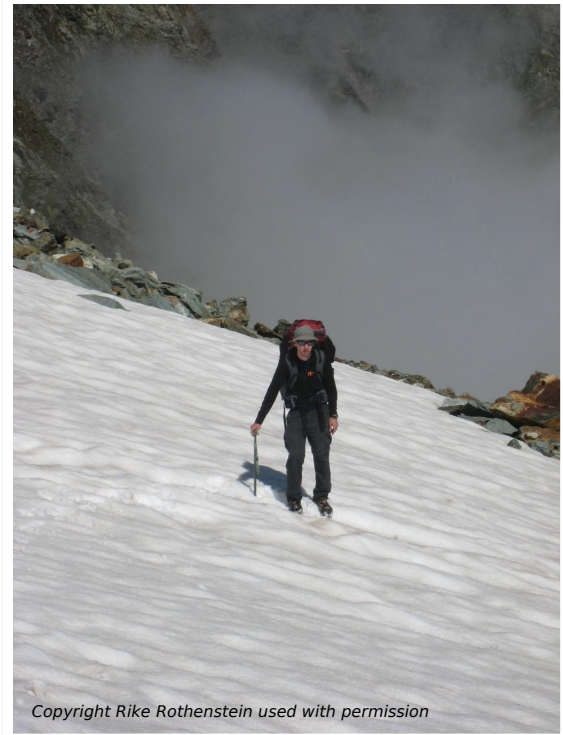
What is an adventure?



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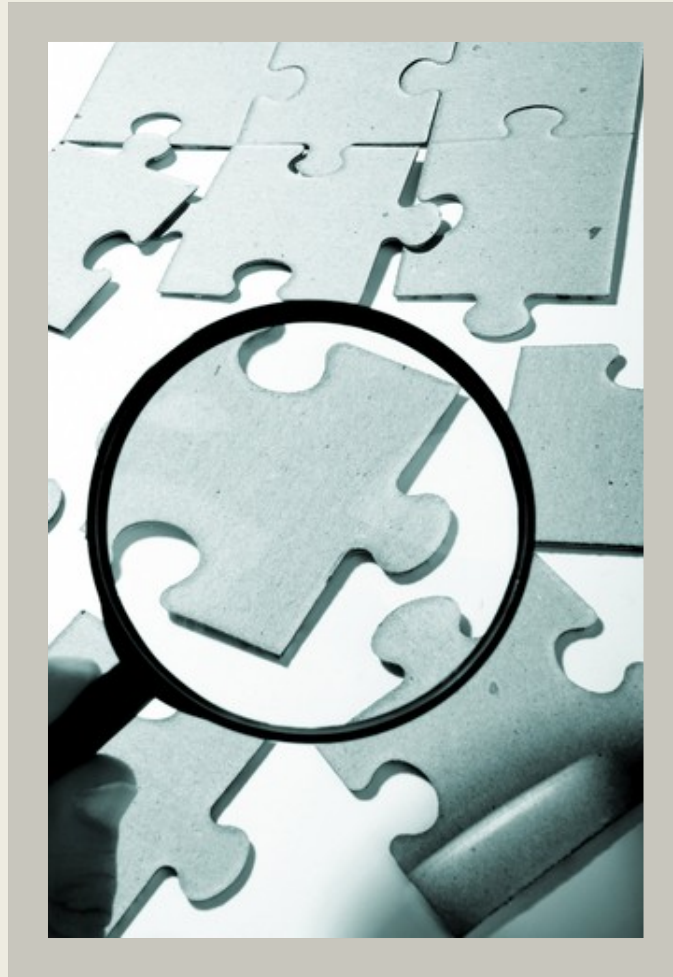


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The
answer
can be
subjective.
Part of the
attraction
of an
adventure
is figuring
out a
puzzle of
importance.





The adventure enjoyment, the eureka euphoria, comes from snapping the missing puzzle piece of experience or knowledge into your mind.

You need
the
surroundi
ng pieces
in place
which can
seem like
work.

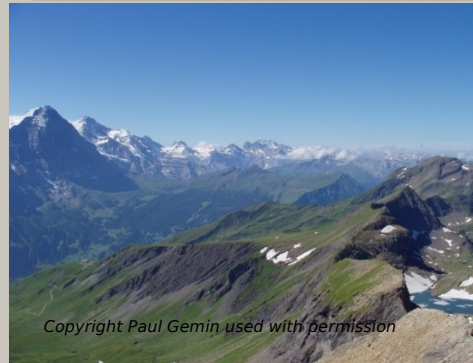




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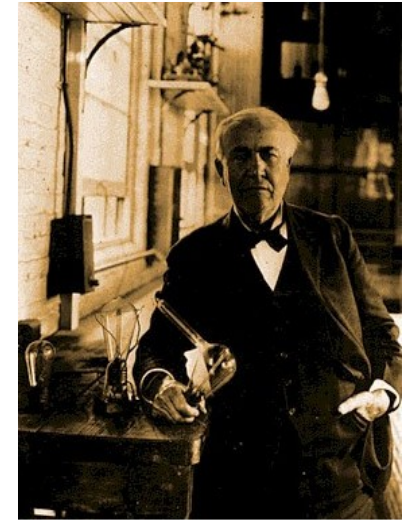
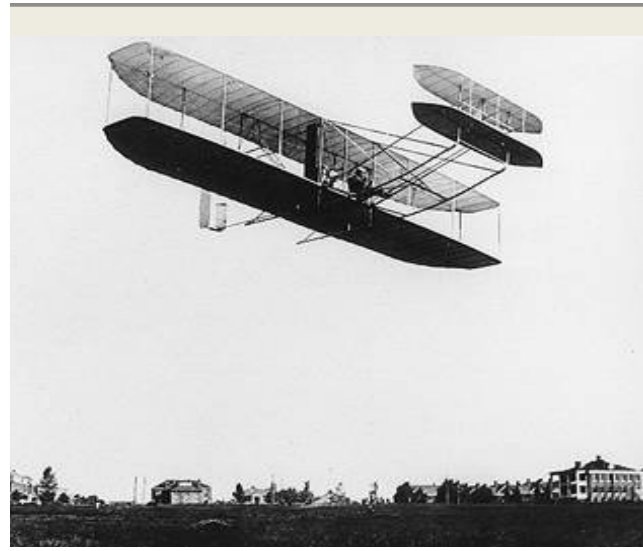


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Like a climber needs to learn skills and develop strength to climb a mountain to experience that euphoric view of the blue sky.

A student of science with knowledge of light and our atmosphere will get a similar rush when he places the puzzle piece of why the sky is blue.





Every science fact is a puzzle to understand. If it wasn't, it wouldn't have taken the thousand of years of recorded history to develop the science puzzle pieces we have today.





These science facts or theories are now recorded and available to those who want to read, think, and start putting their own puzzle picture of science



We can be a part of the daily science explorations by not only doing (becoming a scientist) but also by just reading newspapers and science magazines.



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The unexplored mountains and valleys on earth are few, but there are ever-increasing new science related fields to explore.



Most of us probably missed the chance of exploring new areas in Africa or uncovering ancient Egyptian tombs ...



There are still adventures in science!

To be part of this adventure, we need to understand how to fit the recently discovered science puzzle piece into our existing puzzle picture, doing we become science literate.





I know of no other adventure of
less physical risk, yet more
intellectual rewards!



Science
rewards man
with a better
life and those
that better
their lives
through
science gain
meaningful
employment
as scientists
and



In summary, give learning science a try.

It's a puzzle, it is fun, and there are great rewards.

Learn science and be part of the adventure!!!



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